

May 10, 2005

Mr. Masoud Arjmandi
Arkansas Department of Environmental Quality
Hazardous Waste Division
8001 National Drive
Little Rock, AR 72219

Subject: **Response to Comments**
 Proposed Ozone Pilot System
 Arkwood, Inc. Site, Omaha, AR

Dear Mr. Arjmandi:

In response to your comments dated March 2, 2005 on our proposed ozone pilot system, please see the following (*ADEQ comments in bold italic*, responses follow):

- 1) ***Provide a map showing the locations of injection wells.*** The wells will be placed to intersect the solution channel features that flow toward New Cricket Spring. The wells will be located approximately 25 feet and 50 feet from the sink hole, between the sink hole and the main power pole at the site. A map showing the approximate well locations is attached (Figure 1). The location was chosen based on subsurface features observed during investigation and remediation activities at the site.
- 2) ***Provide construction details of injection wells.*** The wells will be constructed of 6-inch PVC with the lower 10 feet perforated to allow water flow through the lower section of the well. The wells will pass through about 12-18 feet of clay and into 7-13 feet of fractured chert based on previous borings. A rubber bladder will be set approximately 10 feet below ground surface and the area between the casing and drilled hole will be filled with bentonite grout.
- 3) ***Provide rationale for choosing the depth of the injection wells to be approximately 25 feet.*** Based on site investigations and remediation, bedrock in this area is located about 25 feet below the ground surface.
- 4) ***Specify rates and amount of ozone to be injected; and, flow directions (inflow and outflow from the site) of the spring.*** The pilot system will ozonate approximately 30 to 40 gallons per minute of water at a dosage rate of up to 33/mg/l ozone. The ozonated water will be injected into wells installed in the vicinity of the former sinkhole. Based on monitored contaminant discharge (PCP) from the site, the injected ozonated water will flow toward New Cricket Spring. For your reference, a P&I diagram is attached as Figure 2.

5) Provide specific breakdown pathways, both intermediate and final for oxidation of the PCP. The example in the proposal is for the oxidation of ethane to formaldehyde. Show how PCP would be oxidized or the resulting compound. Would CL ions or HCL be formed? How will that affect pH? Pentachlorophenol (PCP) is readily ozonated by ozone. Reaction rates and subsequent degradation products are to a degree pH dependent, with neutral to basic environments reacting faster than in acidic environments. The primary mechanism of oxidation is direct electro-philic attack of ozone through an addition/elimination mechanism. Initial intermediate degradation products are principally tetrachloro-p-benzoquinone and tetrachloro-p-hydroquinone. These compounds are further degraded by ozone and hydroxyl radicals (a byproduct of ozone decomposition) to other open ring products including ketones and acids that are further oxidized to oxalic acid with a quantitative release of chloride ions. In summary, oxidation of PCP results in low molecular weight acids, chloride ions, CO₂ and water. Ozonation of PCP has a negligible effect on pH.

If you have any additional questions, please call me at (608) 848-4134. We look forward to conducting the pilot activities this summer.

Sincerely,

Jean Mescher, Project Coordinator
Director, Environmental Services

Attachments

Copy:

- Shawn Ghose, EPA Project Coordinator (certified mail)
- Frank Robinson (w/o attachments)